DIAGNOSIS BY BLOOD EXAMINATION.

H. W. FURNISS, M. D., INDIANAPOLIS.

[Read before the Marion County Medical Society, Feb. 23, 1897. Before the Indiana State Medical Society, at Terre Haute, May 19, 1897.]

About all that is known of the blood in its clinical aspect has been found out in the past fifteen years, and the greater part of our knowledge can be referred to the present decade. The first great discovery occurred in 1658, when Swammerdan discovered the corpuscle, but from then, all is a blank until 1845, when Virchow noted the great increase of the white blood corpuscles in leukemia. It was not until 1880, when Laveran discovered the plasmodium, that the first careful study of the blood as related to disease was commenced. From that time till this the attention of many investigators has been turned to the blood in the hope that a number of obscure diseases and conditions might be cleared up. In some particulars, success has marked the effort, as in the diagnosis of central pneumonia, deep-seated suppurations, typhoid fever, and diabetes, and in the prognosis of post-scarlatinal nephritis and pneumonia, it has even gone beyond our expectations, while in the diseases in which we were more certain that light would be shed, such as rheumatism, furunculosis, syphilis and the much dreaded uræmia, diseases supposed to be in great part blood diseases, little light has been shed.

That blood examinations have taken such a stride of late is due to the improvement in instruments for examination, differential stains and consequent lessened labor and increased accuracy. About all that is necessary to be known about the blood in a given case can be ascertained in fifteen minutes, and since there are several diseases in which it is possible to make a positive diagnosis by blood examination

alone, several others that an examination will materially aid in diagnosis, others in which the negative result obtained aids us, to say nothing of the valuable assistance rendered in those cases in which we can not communicate with the patient, either because of stupidity, insanity, age, deception or unconsciousness. I deem it well worth even the busiest practitioner's time to avail himself of this aid to diagnosis, and particularly so in the case of fever, as there is no case in which a blood examination would not throw light.

To make a thorough examination of blood, it is necessary to find out the following facts: number of red cells in given quantity, which is usually a cmm.; number of white cells in same; ratio of white to red; number of each kind of white cells; ratio to each other; size, shapes, peculiarities and contents of cells; per cent. of hemoglobin; color value or relative amount of hemoglobin per red cell; relative amount of fibrin, and finally if any substance other than the above occurs, and, if so, of what nature.

In order to understand and recognize the pathology of the blood, it is necessary to thoroughly understand the histology of the normal blood, and under all possible conditions such as drying, etc. This can be gleaned in part from books and plates, but must be seen and studied for one's self to be understood and be of any practical benefit.

Normally the blood consists of red and white cells, blood plates and plasma. The red cells are of one kind and are round disks averaging 7.5μ. The white cells are divided into small lymphocytes, about the size of red blood cells and having a small ring of protoplasm around the large nucleus; large mononuclear lymphocytes, differing from those just mentioned only in size; polynuclear neutrophyles, having nuclei surrounded by a number of granules which stain with neutral dyes, the nuclei usually taking the form of the letters Z, W., etc.; eosinophyles, having a nucleus which takes a basic stain and is surrounded by a number of granules that take acid stain like eosin; and lastly a variety styled basophylic because of

its taking up the base dyes. In disease we may frequently find five kinds of red cells, the plain or normal red cell; a cell the same size as the normal, called normoblast, but containing a nucleus which stains deeply throughout; a red cell larger than normal, megaloblast, containing a nucleus as large as a red cell and the nucleus staining pale and taking on several different shades; the microblast, a cell smaller than normal, usually frayed out along the edges and containing a nucleus large for size of cell; the malarial cell with its many changes; and the irregularly sized and fantastic formed cells, such as are met with in pernicious anemia. So also in pathological blood, we find new kinds of white corpuscles, notably the myelocyte, a spherical cell larger than a red cell and having a larger nucleus, which stains pale and is surrounded by neutrophylic granules, and a second form of cell which resembles the myelocyte, except that the granules take eosin. Normally the blood contains 5,500,000 red blood corpuscles in a cmm. in the male, and about a million less in the female. These numbers vary much in disease, being increased a million or more in Asiatic cholera, after diarrhea, or profuse sweating, and has been known to be decreased to 143,000 in some forms of pernicious anemia. The average number of white cells per cmm. is 7,000, about one white to 714 red, though the ratio has been known to have been reduced to 1:1, and Osler has recorded a case in which even a greater ratio existed. The greatest number observed has been 114,000 per cmm.

In health the proportion of kinds of white cells is definite, while in disease it varies and thus becomes a valuable aid to diagnosis. The ratio in health is :

Polynuclear neutrophyles	60–75%
Lymphocytes	20–30
Large mono-leucocytes and transitional forms	6
Eosiniphiles	2– 4
Basophyles	1

Normally the number of blood plates varies from 200,000 to 300,000. They are increased in lukemia and severe anemia, diminished or absent in pupura, hemophilia and malaria dur-

ing fever. Blood for examination is best obtained by puncture of a finger or a lobe of an ear, preferably the latter, as the blood flows more freely; the puncture causes less pain and the operation is not observed and consequently less resisted. I find that the best instrument to use is a sharp, three-cornered needle. The lobe is washed with soap and water, alcohol or ether, to get rid of whatever of dead epithelium, dirt, and oil may be present and is then rubbed dry. The needle is plunged in with a quick motion, thereby causing less pain and allowing a better flow of blood. Some sterilize the needle in a flame before each puncture, but you may use your pleasure about that. I follow the practice of the Massachusetts General Hospital, and just clean mine off, and have never had a bad result, and the same has been the case with over 10,000 examinations in the above stated hospital. Perhaps the reason for the lack of infection is, as Cabot says, because the first two or three drops are always wiped away, and the specimen taken from the drops that follow. Care must be exercised that the blood is not squeezed out of the puncture, but rather that it flows out itself, as otherwise the specimen would not be a fair one, containing, as it would, more liquid constituents than solid. The best time to take the specimen is near meal-time, preferably before breakfast, as physiological leucocytosis takes place soon after meals, and it has been found that the blood will be found in its average condition at the above stated time.

If the corpuscles are to be counted, the blood is sucked up from the exuding drop, and the Thoma-Zeiss pipette filled to exactly the proper point and the correct dilution made, and from this dilution the counting cell filled. Let me warn you here of the necessity of having all instruments scrupulously clean, and to use the greatest care to accurately follow directions, as even a very small mistake will amount to a great deal in the aggregate, and either confuse or render the whole work unreliable and useless.

If it is desirous to examine a specimen of fresh blood a

clean cover-glass is dropped face down upon a clean slide, when the blood will spread out in an even film and be ready for examination. That the blood may spread evenly, slide and cover-glass must be perfectly clean. I have tried the usual methods of cleaning slides and covers, and find that none succeed as well as soap and water to wash them with, and a clean soft rag to wipe them good and dry. Then this method has the advantage of always having the necessary material at hand. It is best to handle cover-glasses with forceps, as the moisture from the hand would alter a specimen or prevent a good film. If it is desirous to observe a fresh specimen for some time, as in the case of malarial blood, it is advisable to paint a thin coat of vaseline around the edge of the cover-glass to prevent the drying of the specimen and to get rid of the blood currents formed in drying blood. Again, specimens should be examined in a warm room, otherwise it would be necessary to use some form of warm stage.

The examination of fresh blood is the best known way to ascertain the presence of and study the filaria sanguinis hominis, plasmodium malariæ, spirochete of relapsing fever and the rouleux forms of red cells, and to one skilled in blood examination many of the facts that otherwise could be told only by the more laborious method of fixing and staining can be told with sufficient accuracy at a glance.

When it is desirous to make permanent specimens or study the effects of stains, it is first necessary to spread a thin film of blood upon cover-glass or slide and fix it there. The film is spread by touching clean cover-glass to the drop of blood, then dropping another clean cover-glass upon the first one, allowing the blood to spread out between them by capillary attraction and then sliding the cover-glasses carefully apart. The bottom one usually contains the best specimen. A thin film over a large surface may be obtained by taking the tissue paper in strips about the width of a slide, touching the paper to the exuding drop of blood, placing the charged surface of the paper near one, and gently drawing the paper to the other

end of the slide, when a uniform film will be found upon the slide.

For fixing and hardening, immersing the specimen for a few moments in equal parts of alcohol and ether is a favorite method, yet I find that we get better results if we leave the specimen in the solution an hour or so. Heating specimen to 110° C. has its advocates, and there are many methods and apparatus proposed to accomplish this. I prefer about a 1 per cent. solution of formaline in alcohol, which has the advantages of being quick and as good as the best.

I shall not burden you with the technique of blood-counting, hemoglobin estimation and formulæ for the different kinds of stains, etc., as all of that can be found in any good book treating of the blood. Suffice to say that the Thoma-Zeiss instrument still holds its own as the best blood counter in spite of the much lauded hematocrit. The chief defect of the hematocrit is the fact that variations in size or shape of corpuscles will cause difference in packing of cells in tube, and since number is estimated by bulk, it is evident that it would be grossly inaccurate in many cases in which accuracy would be essential for diagnosis. Then the inability to tell in many cases just where the red cells end and the white begin, or where the white end or begin, deprives it of that accuracy which we would wish to have. I do not mean to have you believe that the Thoma-Zeiss instrument is free from defects, yet, with a given observer, be he skilled or otherwise, the chances of error are greater with the hematocrit.

The instrument most used to estimate hemoglobin is Fleischl's. Its success depends upon one's ability to match colors. Color-matching is not easy at its best, and one has but to try it with one's friends to see how few have a sensitiveness for shades. How much greater then is the chance of inaccuracy when one has to match a liquid in one-half a cell with their rays of light transmitted through water, and a prism of Cassius purple of a progressive depth of shade. A difference of twenty degrees of color exists between the ex-

tremes of the part of the prism exposed through the cell and that tends to complicate matters. For the above stated reasons I prefer to use the simpler and more available method of Hammerslag. The apparatus necessary is an urinometer, urinometer glass and a dropper. The urinometer glass having been previously washed and dried is partly filled with a mixture of chloroform and benzol in such proportions that the mixture has a specific gravity of 1059. A drop of blood from a fresh puncture is drawn up into the dropper and then forced out into the mixture. The blood will not mix with the chloroform benzol mixture, but will still maintain its globular form and sink, float, or rest at ease at some depth in the mixture according to whether the specific gravity of the drop is equal to or higher or lower than the mixture. If it rises to the top, benzol is added; if it sinks to the bottom, choloroform is added, until the drop comes at rest somewhere near the center of the mixture. Then the specific gravity of the mixture is taken, and by referring to a table the hemoglobin is estimated. The specific gravity of the blood plasma varies very little from any cause except in dropsy, and in the corpuscles themselves the variable element is the hemoglobin, consequently in most non-dropsical patients the specific gravity of the whole blood varies as directly as the hemoglobin. Specific gravity of 1030 is equal to 25 per cent., and 1059 to 100 per cent.

I shall not attempt to go into the chemistry of blood testing, its alkalinity, amount of gases, etc., as such examinations are poor at their best and are of no aid to diagnosis. Naturally, the first disease that my paper would bring to your mind is anemia and chlorosis, and rightly, too, as no little of the diagnosis and prognosis can be told from a blood examination. Anemia is a diminution in red blood corpuscles, hemoglobin, or both, and is independent of color of skin or mucous membrane. The greater number of times it is impossible to tell pernicious anemia from chlorosis except by examination of blood. In the former you nearly always have decrease in

number of cells and a greater alteration, decrease or increase in size and form of red corpuscles, the color value being high, while in chlorosis you may have decrease in red cells, but the principal thing is lack of cell-hemoglobin or color value.

Then you may have megaloblasts in chlorosis, but normoblasts are greater, while reverse is true in anemia. True, you may have diminished red cells in malignant disease, but then you nearly always have leucocytosis which will help to distinguish; then normoblasts predominate in malignant diseases; megaloblasts in anemia. Those diseases which do not cause leucocytosis, but lessen corpuscles, do not have megaloblasts or high color value, and leukemia can always be told on account of the great number myelocytes. In anemia search carefully for nucleated corpuscles, for if any be present they will aid much in prognosis. Megaloblasts and no other nucleated forms is a bad sign. It is the kind of nucleated corpuscles and not number that is of interest, the ratio of megalo to normoblasts that is important. Low color index and normal cells show improvement at the time; high color index is a bad sign.

In leukemia the red cells are slightly diminished, the white markedly increased. About 30 per cent. of the white cells are myelocytes, and in lymphatic forms 90 per cent. are lymphocytes. Leukemia is distinguished from Hodgkin's disease, which has the same symptoms, by the blood being normal in early stages of the latter disease, and in the latter stages not more than a slight anemia existing.

It is possible to diagnose shock of hemorrhage from concussion or compression by blood count, there being a marked decrease in red corpuscles in the former and none in the latter. In the same way internal hemorrhage can be told from peritonitis or obstruction, and the advisability of an operation after loss of blood can be safely told by estimation of hemoglobin, a per cent. lower than thirty being a contra indication.

Again, it is possible to tell if one's patient has been in reality fasting by making a blood count when, if it is so, there will be a marked decrease in leucocytes, but it must be borne

in mind that diseases of the stomach and small intestines may prevent leucocytosis. Then it must be remembered that pregnancy, violent exercise, cold baths and massage may cause leucocytosis; but in each of these cases the proportion of white cells remains about the same, only that the number is increased. In disease we may expect leucocytosis after hemorrhage, with malignant disease and inflammation; and an absence with measles, malaria, typhoid fever and all forms of tuberculosis.

Typhoid fever is easily told by Widal's method or Johnson's modification. Diagnosis depends upon the fact that blood or blood serum from a patient with typhoid will cause a drop of actively motile typhoid bacilli to cease motion and clump. Positive results are not always obtained, but nearly always so. Acuteness or mildness of attack does not seem to have any appreciable difference on the clumping. Johnson's method consists in collecting a specimen of blood on a sterilized paper and allowing it to dry, thus permitting of transportation, a great factor for municipal laboratory work. The dried blood is dissolved in a few drops of sterilized water, and a small portion of the solution added to a drop of bouillon containing actively motile bacilli typhosis. To make a success of it, it is necessary to have a pure, fresh culture of typhoid, and it has been observed that an attenuated culture works better than a more virulent one. The time necessary for the specimen to cause clumping should not exceed thirty minutes, and this clumping does not seem to be a killing of the bacilli, but just a paralyzing. It is said that this clumping can not be caused by any other disease, yet it is quite necessary that the serum or blood should be considerably diluted, as it has been observed that sometimes healthy serum undiluted would cause this phenomenon, while only diluted typhoid blood would produce the reaction.

During the meeting of the state sanitarians last week in Indianapolis the press stated that this reaction does not occur with blood taken from a negro having typhoid. This state-

ment is erroneous, as I shall demonstrate to-day. I have made a critical study of nine cases of typhoid in the negro and got the reaction from each of them, as did also Dr. Reed, pathologist to the Army Medical Museum, Washington, to whom I submitted samples for verification. I have also examined the blood of a number of negroes suffering with different diseases, and in health, and failed to get the reaction in any case, so I am led to believe that the blood of the negro will react as often and with the same degree of certainty as that of other races.

Pneumonia is distinguished from typhoid, malaria, or plain la grippe when symptoms are present and no physical signs, by the marked leucocytosis of the former. There is no means of diagnosing pneumonia from capillary bronchitis. In pneumonia there is always a marked fibrin network. So far as prognosis goes, the absence of leucocytosis is always an unfavorable sign, while its presence leaves the matter in doubt, though favorable for recovery. Hare says leucocytosis is checked by antipyretics, but not by cold bathing, but I wonder how many of us heed that.

Blood examinations are of no value in diagnosis of diphtheria. Cabot claims that in prognosis absence of leucocytes except in mild cases, and the presence of myelocytes is unfavorable.

Septicemia can be diagnosed by bacteriological examination of blood. Rheumatism can not be told, and no particular light is shed by examination. La grippe, according to Cannon, can be diagnosed by finding the specific micro-organism in stained specimen of blood.

Scarlet fever is distinguished from measles in that the latter never has leucocytosis while the former always has. In scarlet fever eosiniphiles are absent in bad cases, and increased in favorable cases, and the same rule holds good for post-scarlatinal nephritis.

Appendicitis can not be told from pus-tube by examination of the blood, but can be told from colic, constipation, floating

kidney, ovarian or pelvic neuralgia, gall stone and renal colic if uncomplicated, because of the leucocytosis in the former and lack of it in all the other cases.

Cholera can be diagnosed in much the same way as typhoid fever, with the added fact that the alkalinity of the blood is markedly decreased and with death becomes acid. In peritonitis we have marked leucocytosis and increase in fibrine net-work, but there is no leucocytosis in tubercular peritonitis and it may thus be diagnosed. Pericarditis with effusion can be told from hypertrophy or dilatation on account of the marked leucocytosis in the former case. In meningitis you always have leucocytosis, while in no other form of intercranial disease except abscess and apoplexy do you have this phenomenon. On account of the always present leucocytosis meningitis can be told from typhoid, which it simulates, but could not be told by blood examination from pneumonia.

Justus claims to be able to diagnose syphilis before the secondary symptoms have appeared. He first estimates the per cent. of hemoglobin, then gives innunction or injection of mercury, and finds that the hemoglobin falls from 10 to 20 per cent. in a day, which he attributes to the action of the mercury on the weaker blood cells. After a few days, this marked diminution is followed by a gradual rise and soon the per cent. of hemoglobin is higher than it was before. He states that syphilis is the only disease in which the facts stated occur. Blood examinations otherwise are negative, except so far as diagnosing the severity of the affection. Large numbers of young white cells and small per cent. of hemoglobin are indicative of severe cases. Cases having myelocytes are serious, while we look for leucocytosis after the primary stage.

In asthma, we have a marked increase in eosinophyles just prior or subsequent to attack. Schriber distinguishes bronchial from cardiac or renal asthma by increase in eosoniphyles.

According to Bremmer, of St. Louis, it is possible to diagnose diabetes by blood examination long before it could otherwise be told. His method is very simple. He heats two blood

films, one normal and the other of suspected blood, in a hot air sterilizer for six or seven minutes at temperature of 135 C. He then allows specimen to cool, and when cold he exposes the two to a 1 per cent. aqueous solution of Congo red or methyl blue for two minutes, when the normal blood will be stained red or blue, and the other if diabetic will resist the action of the stain. Then there is the Williamson method, which depends upon the power of diabetic blood to remove the blue color from a solution of methyl blue. The reaction is said to be so sensitive that it only requires a very small quantity of blood. Certain proportions of blood and a warm alkaline solution of methyl blue are mixed together, the blue color is removed in the case of diabetic blood, but remains when non-diabetic blood is used. In purpura hemoragica, hemophilia and scurvy, diseases in which you would expect to find a great deal from a blood examination, there is little or no characteristic change.

In examining the blood for malaria it is best to take the specimen before or after the chill, as then the plasmodium is larger and pigmented. I prefer to study the suspected blood when fresh, and if I find the plasmodium it is always a matter of pleasure to watch it assume some of its many forms. I do not think that it takes much skill to find the plasmodium, provided you know what you are looking for and are patient and painstaking, and once you find it, it will be quite easy in the future to recognize it. Staining, though, has its advantages, as it is thus easier to see the organism; one can examine it at one's leisure, and there is not the danger of confusing the plasmodium with other things found in the blood. The best stain to use is Phlen's, which is a combination of methylene blue and eosin soluble in alcohol, though single staining with methylene blue will do. In either case the blue stains the plasmodium itself, and when eosin is used the corpuscle substance is stained pink. In all cases of suspected malaria, the blood should be examined, as clinical symptoms alone often warrant a diagnosis of malaria when tuberculosis, syph-

ilis, septic infection, or something else, is the true cause of symptoms. Those who have examined blood often will bear me out in the statement just made, as they will also testify to the number of instances in which more serious maladies have been diagnosed when blood examination would prove the affection to be malaria. The plasmodium is always found in malaria, and should one fail to find it in one examination try again, if the malarial symptoms persist, but if the patient tells you that he has been taking quinine for some days or only has taken a few doses, then do not wonder if you fail to find the plasmodium, as quinine is a specific and soon rids the blood of the micro-organisms.

Filaria in the blood is rare, yet we have had a case in this state, in the practice of Dr. F. B. Wynn, of Indianapolis, reported in a recent issue of the Indiana Medical Journal. The queer thing about the parasite is that it never gets in the peripheral circulation until the host is asleep, so, to get a specimen of it, it is always necessary to take the blood of the patient while asleep or immediately after waking. Every one is familiar with the angle-worm-like picture of the filaria, and I am sure you would recognize it if you saw it. In pelvic abscess we have leucocytosis, while in pure pelvic pain, soreness, endometritis and cystitis, there is no leucocytosis. Osteomyelitis in connection with the symptoms may be distinguished from other affections which might cause the same train of symptoms by the marked leucocytosis in the former case.

Pleurisy may be diagnosed from empyema, pneumonia and malignant lung trouble; and cyst of the kidney, from perinephritic abscess, by the absence of leucocytosis.

Diagnosis of malignant disease is said by some to be made by blood examination. I have had little encouragement from such examinations, either so far as diagnosis or prognosis is concerned. Cabot gives the following notes for the diagnosis of malignant disease:

1. When we are dealing with an obscure, deep-seated disease, if hemorrhage is excluded, the presence of persistent

leucocytosis suggests suppuration or malignant disease (rather than tuberculosis or syphilis for example), and excludes any simply functional or hysterical affection. The absence of leucocytosis, however, does not exclude malignant disease, though it makes suppuration very unlikely.

2. Between malignant disease and suppuration, if the other signs and symptoms do not decide, there may be nothing in the blood to decide. In decided pyemia we may get pyogenic cocci from the blood by culture, but a negative result would exclude the suppurating focus. The absence of any increase of fibrin in the blood speaks against suppuration and therefore in favor of malignant disease, but the presence of increased fibrin network is not decisive either way, as it may be met with in connection with neoplasm, though more commonly in suppuration.

3. Between malignant disease and hemorrhage a marked anemia favors the latter, provided the case is a recent one, for the anemia of malignant disease is comparatively slow to develop. The leucocytes give no help.

4. Between cancer and ulcer of the stomach, if there has been a recent hemorrhage, leucocytosis favors cancer, but its absence is of no weight either way.

5. Hemoglobin decreases steadily in cancer, while in ulcer it tends to return toward normal after the cessation of hemorrhage.

6. The presence and persistence of digestion leucocytosis speaks against cancer and its absence in favor of cancer.

7. Between cancer of the liver or bile ducts on the one hand, and simple gall stones, colic or obstruction, the presence of leucocytosis favors cancer.

8. The appearance in the blood of large numbers of eosiniphiles, myelocytes and nucleated corpuscles, during the course of a malignant disease, points to bone methastasis.

9. When leucocytosis, which has disappeared after removal of a neoplasm, reappears, we may expect a recurrence of the growth shortly.

10. A steady increasing leucocytosis in a case of malignant disease points to a rapid growing tumor or the occurrence of metastesis.

11. Between malignant disease and pernicious anemia, the diagnosis rests on the following points:

a. Color index, low in malignant, apt to be high in pernicious anemia.

b. Leucocytes, increased in malignant, diminished in pernicious anemia.

c. Average size of red cells often decreased in malignant and often increased in anemia.

d. If nucleated red corpuscles are present, normoblasts are in majority in malignant disease and minority in pernicious anemia.

f. The presence of leucocytosis is against the benignancy of any tumor.

Holmes, of Denver, claims to be able to diagnose tuberculosis in its earliest stages by blood examination, even when it is impossible to tell it either by physical signs or sputum examination. I am in hopes that his dubious assertions may stand the test of time, for if we are to do anything with that greatest of devastating disease we must do it in its incipiency.

In most cases, after the germs are discoverable in the sputum, and there can be no doubt of the infection, the only thing that seems to check their growth is the death of the host. Holmes bases his theory upon the assertion that each individual has a biological prototype in the leucocytes of his own blood. He further claims the following characteristics of tubercular blood: Marked deviation from normal percentage of all varieties of leucocytes; great decrease in percentage of small lymphocytes; usually a marked increase in percentage of large lymphocytes; many giant lymphocytes, with irregular contour and protruding globules of hyaloplasm; eosiniphile cells, absent or few in number, only in severe cases; myelocytes occasionally present; marked cell disintegration; many groups of debris from disintegrating leuco-

cytes; phagocytes, with indistinct cell contour and granules few in number, poorly stained and scattering; marked irregularity in size and appearance of phagocytes, dwarf phagocytes as small as small lymphocytes, giant phagocytes double usual size, with five or more nuclei; often a clear, narrow and sharply-defined ring separating the nucleus from the cell body in small and large lymphocytes; phagocytes, with granules taking a basophylic tint, evidence of approaching dissolution; grouping together of a large number of phagocytes observed before dissolution; very little disintegration of red cells. Holmes' views have not attracted as much attention among scientific physicians as they have among the laity and secular newspapers.

Finally the examination of blood in post-operative temperature is of value to determine if pus is present, as with pus there is always leucocytosis, and absence of leucocytosis in suspected appendicitis should make one hesitate about operating.

I have attempted to give some of the ways in which blood examinations may aid in diagnosis. Any one of the subjects mentioned would be sufficient for a paper, so I hope you will pardon me for the briefness with which I have touched on each disease, yet I have attempted to give the essential facts and hope that my paper may arouse sufficient interest to indicate how much of valuable assistance blood examinations may give, particularly in obscure cases.

New 132 W. New York Street.